IN THE CLAIMS

1. (withdrawn) A digital subscriber line transmission method for transmitting downstream data from a device on an office side to a device on a subscriber side and upstream data from the device on the subscriber side to the device on the office side over a single line by switching between these data transmissions in time-division fashion, dividing data of one symbol, modulating carrier waves having different frequencies by each item of divided data and frequency-multiplexing the modulated signals, and transmitting the frequency-multiplexed signals a few symbols at a time, said method comprising the steps of:

generating a training symbol sequence, which comprises a plurality of successive symbols, in bursts on a training-symbol transmitting side at time of training carried out prior to data communication;

adding some data that is contained within the training symbol sequence onto at least one of the beginning and the end of this symbol sequence; and

transmitting the training symbol sequence onto which some of the data has been added to a training-symbol receiving side.

2. (withdrawn) A digital subscriber line transmission method for transmitting downstream data from a device on an office side to a device on a subscriber side and upstream data from the device on the subscriber side to the device on the office side over a single line by switching between these data transmissions in time-division fashion, dividing data of one symbol, modulating carrier waves having different frequencies by each item of divided data and frequency-multiplexing the modulated signals, and transmitting the frequency-multiplexed signals a few symbols at a time, said method comprising the steps of:

generating a training symbol sequence, which comprises a plurality of successive symbols, in bursts on a training-symbol transmitting side at time of training carried out prior to data communication;

adding some data that is contained within the training symbol sequence onto at least one of the beginning and the end of this symbol sequence;

transmitting the training symbol sequence onto which some of the data has been added to a training-symbol receiving side; and

removing the data, which has been added onto the training symbol sequence, on the receiving side.

3. (withdrawn) The method according to claim 1, wherein length of a training symbol sequence after data has been added thereon at the time of training and of a transmit symbol sequence at time of normal communication is set in such a manner that the symbol sequence will not fall within an interval in which effects of near-end crosstalk from a neighboring line are received.

4. (withdrawn) A digital subscriber line transmission method for transmitting downstream data from a device on an office side to a device on a subscriber side and upstream data from the device on the subscriber side to the device on the office side over a single line by switching between these data transmissions in time-division fashion, dividing data of one symbol, modulating carrier waves having different frequencies by each item of divided data and frequency-multiplexing the modulated signals, and transmitting the frequency-multiplexed signals in bursts a few symbols at a time, said method comprising the steps of:

generating a pilot-tone signal with which synchronously processing is executed;

generating the pilot-tone signal with which synchronously processing is executed;

making the length of an interval in which a signal is not being transmitted between contiguous transmit burst symbol sequences a whole-number multiple of the cycle of the pilot-tone signal; and

assuring continuity of sample data in contiguous transmit burst symbol sequences by executing processing in sync with the pilot-tone signal.

5. (withdrawn) A digital subscriber line transmission method for transmitting downstream data from a device on an office side to a device on a subscriber side and upstream data from the device on the subscriber side to the device on the office side over a single line by switching between these data transmissions in time-division fashion, dividing data of one symbol, modulating carrier waves having different frequencies by each item of divided data and frequency-multiplexing the modulated signals, and transmitting the frequency-multiplexed signals a few symbols at a time with a cyclic prefix attached onto each symbol, said method comprising the steps of:

generating a pilot-tone signal with which synchronously processing is executed;

making a phase difference between phase of a training symbol and phase of a transmit symbol from which a cyclic prefix has been removed at time of normal communication a whole-number multiple of a pilot-tone cycle; and

executing training processing and processing for normal data communication in sync with the pilot-tone signal.

6. (withdrawn) A digital subscriber line transmission apparatus for transmitting downstream data from a device on an office side to a device on a subscriber side and upstream data from the device on the subscriber side to the device on the office side over a single line by switching between these data transmissions in time-division fashion, dividing data of one symbol, modulating carrier waves having different frequencies by each item of divided data and frequency-multiplexing the modulated signals, and transmitting the frequency-multiplexed signals a few symbols at a time, said apparatus comprising:

a training symbol generating unit for generating a training symbol sequence, which comprises a plurality of successive symbols, in bursts at time of training carried out prior to data communication;

a redundancy data add-on unit for adding some data that is contained within the training symbol sequence onto at least one of the beginning and end of this symbol sequence as redundancy data; and

a transmitting unit for transmitting the training symbol sequence onto which the redundancy data has been added to a training-symbol receiving side.

7. (withdrawn) A digital subscriber line transmission apparatus for transmitting downstream data from a device on an office side to a device on a subscriber side and upstream data from the device on the subscriber side to the device on the office side over a single line by switching between these data transmissions in time-division fashion, dividing data of one symbol, modulating carrier waves having different frequencies by each item of divided data and frequency-multiplexing the modulated signals, and transmitting the frequency-multiplexed signals a few symbols at a time, said apparatus comprising:

a training symbol generating unit for generating a training symbol sequence, which comprises a plurality of successive symbols, in bursts at time of training carried out prior to data communication;

a redundancy data add-on unit for adding some data that is contained within the training symbol sequence onto at least one of the beginning and end of this symbol sequence as redundancy data;

a transmitting unit for transmitting the training symbol sequence onto which the redundancy data has been added to a training-symbol receiving side;

a receiving unit for receiving the training symbol sequence onto which the redundancy data has been added;

a redundancy-data removal unit for removing the redundancy data that has been added onto the training symbol sequence; and

a training processor for executing processing based upon a training symbol from which the redundancy data has been removed.

8. (withdrawn) The apparatus according to claim 6, further comprising means for setting length of a training symbol sequence after the redundancy data has been added thereon at the time of training and of a transmit symbol sequence at time of normal communication is set in such a manner that the symbol sequence will not fall within an interval in which effects of near-end crosstalk from a neighboring line are received.

9. (withdrawn) A digital subscriber line transmission apparatus for transmitting downstream data from a device on an office side to a device on a subscriber side and upstream

data from the device on the subscriber side to the device on the office side over a single line by switching between these data transmissions in time-division fashion, dividing data of one symbol, modulating carrier waves having different frequencies by each item of divided data and frequency-multiplexing the modulated signals, and transmitting the frequency-multiplexed signals in bursts a few symbols at a time, said apparatus comprising:

a pilot-tone signal generator for generating a pilot-tone signal with which synchronously processing is executed;

means for making the length of an interval in which a signal is not being transmitted between contiguous transmit burst symbol sequences a whole-number multiple of the cycle of the pilot-tone signal; and

means for executing processing in sync with the pilot-tone signal and assuring continuity of sample data in contiguous transmit burst symbol sequences.

10. (withdrawn) A digital subscriber line transmission apparatus for transmitting downstream data from a device on an office side to a device on a subscriber side and upstream data from the device on the subscriber side to the device on the office side over a single line by switching between these data transmissions in time-division fashion, dividing data of one symbol, modulating carrier waves having different frequencies by each item of divided data and frequency-multiplexing the modulated signals, and transmitting the frequency-multiplexed signals a few symbols at a time with a cyclic prefix attached onto each symbol, said apparatus comprising:

a pilot-tone signal generator for generating a pilot-tone signal with which synchronously processing is executed;

means for making a phase difference between phase of a training symbol and phase of a transmit symbol from which a cyclic prefix has been removed at time of normal communication a whole-number multiple of a pilot-tone cycle; and

means for executing training processing and processing for normal data communication in sync with the pilot-tone signal.

11. (withdrawn) A digital subscriber line transmission apparatus for transmitting downstream data from a device on an office side to a device on a subscriber side and upstream data from the device on the subscriber side to the device on the office side over a single line by switching between these data transmissions in time-division fashion, dividing data of one symbol, modulating carrier waves having different frequencies by each item of divided data and frequency-multiplexing the modulated signals, and transmitting the frequency-multiplexed signals a few symbols at a time, said apparatus comprising:

a training-symbol transmitting unit for receiving a training symbol via said line;

said training-symbol transmitting unit including:

a training-symbol generating unit for generating a training symbol sequence comprising a plurality of successive symbols;

a redundancy data add-on unit for adding some data that is contained within the training symbol sequence onto at least one of the beginning and end of this symbol sequence as redundancy data; and

a transmitting unit for transmitting the training symbol sequence onto which the redundancy data has been added to the training-symbol receiving unit; and

said training-symbol receiving unit includes:

a receiving unit for receiving the training symbol sequence onto which the redundancy data has been added;

a redundancy-data removal unit for removing the redundancy data that has been added onto the training symbol sequence; and

a training processor for executing processing based upon a training symbol from which the redundancy data has been removed.

12. (withdrawn) The system according to claim 11, wherein said line and another line on which transmission of downstream data and transmission of upstream data are performed in time-division fashion are accommodated in a cable which connects said training-symbol transmitting unit and said training-symbol receiving unit; and

said training-symbol transmitting unit has means for setting length of a training symbol sequence after redundancy data has been added thereon and of a transmit symbol sequence at time of normal communication in such a manner that the symbol sequence will not fall within an interval in which effects of near-end crosstalk from said other line are received.

13. **(currently amended)** A digital subscriber line transmission method for transmitting downstream data from a device on an office side to a device on a subscriber side and upstream data from the device on the subscriber side to the device on the office side over a single line by switching between these data transmissions in time-division fashion, dividing data of one symbol, modulating carrier waves having different frequencies by each item of divided data and frequency-multiplexing the modulated signals, and transmitting the frequency-multiplexed signals in bursts a few symbols at a time, said method comprising the steps of:

incorporating timing information, which specifies an interval in which effects of crosstalk from a neighboring line are received, in a training symbol sequence at time of training carried out prior to data communication; and

transmitting the training symbol sequence in which the timing information is incorporated from the device in the office side to the device on the subscriber side ~~so that~~wherein the subscriber side ~~can~~ determines a transmit interval for the upstream data and a receive interval for the downstream data based on the timing information,

wherein the timing information is incorporated in the training symbol sequence by changing the phase between adjacent training symbols by the device on the office side and a phase-change point in the training symbol sequence is detected by the device on the subscriber side and a timing which is a set time before or a set time after the phase-change detection time is adopted as the start timing of said interval.

14. - 15. (canceled)

16. (previously presented) The method according to claim 13, wherein the phase of adjacent symbols constructing a training symbol sequence is varied by 90° or 180°.

17. (previously presented) The method according to claim 13, wherein a carrier wave of a predetermined frequency is quadrature modulated and the phase between adjacent symbols obtained by quadrature modulation is varied.

18. **(currently amended)** A digital subscriber line transmission apparatus for transmitting downstream data from a device on an office side to a device on a subscriber side and upstream data from the device on the subscriber side to the device on the office side over a single line by switching between these data transmissions in time-division fashion, dividing data of one symbol, modulating carrier waves having different frequencies by each item of divided data and frequency-multiplexing the modulated signals, and transmitting the frequency-multiplexed signals in bursts a few symbols at a time, said apparatus comprising:

a timing-information insertion ~~means for inserting~~ unit to insert timing information, which specifies an interval in which effects of crosstalk from a neighboring line are received, into a training symbol sequence at time of training carried out prior to data communication; and

a transmitting unit ~~for transmitting~~to transmit the training symbol sequence, into which the timing information has been inserted, from the device on the office side to the device on the subscriber side ~~so that~~wherein the subscriber side ~~can~~ determines a transmit interval for the upstream data and a receive interval for the downstream data based on the timing information,

wherein said timing-information insertion ~~means~~ unit inserts the timing information into the training symbol sequence by changing the phase between adjacent training symbols and the device on the subscriber side detects a phase-change point in the training symbol sequence and adopts a timing which is a set time before or a set time after the phase-change detection time, as the start timing of said interval.

19. - 20. (canceled)

21. **(currently amended)** The apparatus according to claim 18, wherein said timing-information insertion ~~means~~ unit varies by 90° or 180° the phase of adjacent symbols constructing a training symbol sequence.

22. **(currently amended)** A digital subscriber line transmission system for transmitting downstream data from a device on an office side to a device on a subscriber side and upstream data from the device on the subscriber side to the device on the office side over a single line by switching between these data transmissions in time-division fashion, dividing data of one symbol, modulating carrier waves having different frequencies by each item of divided data and frequency-multiplexing the modulated signals, and transmitting the frequency-multiplexed signals in bursts a few symbols at a time, said system comprising:

a cable ~~for accommodating~~to accommodate said line as a first line and another line as a second line on which transmission of downstream data and transmission of upstream data are performed in time-division fashion;

a training-symbol transmitting unit ~~for transmitting~~to transmit a training symbol via said first line at time of training carried out prior to data communication; and

a training-symbol receiving unit ~~for receiving~~to receive a training symbol via said first line;

said training-symbol transmitting unit including:

a timing-information insertion ~~means for inserting~~ unit to insert timing information, which specifies an interval in which effects of crosstalk from said second line are received, into a training symbol sequence at time of training carried out prior to data communication; and

~~means for transmitting~~ a transmitting unit to transmit the training symbol sequence into which the timing information is inserted from the device on the office side to the device on the subscriber side ~~so that~~wherein the subscriber side ~~can~~ determines a transmit interval for the upstream data and a receive interval for the downstream data based on the timing information; and

said training-symbol receiving unit includes:

a timing information extraction ~~means for extracting~~ unit to extract the timing information from the training symbol sequence; and

a processor ~~for executing~~to execute training processing based upon this timing information,

wherein said timing-information insertion ~~means~~ unit inserts the timing information into the training symbol sequence by changing the phase between adjacent training symbols and said timing information extraction ~~means~~ unit detects a phase-change point in the training symbol sequence and adopts a timing which is a set time before or a set time after the phase-change detection time, as the start timing of said interval in which effects of crosstalk from said second line are received.

23. (canceled)

24. **(canceled)**

25. **(currently amended)** A digital subscriber line transmission apparatus for transmitting downstream data from a device on an office side to a device on a subscriber side and

upstream data from the device on the subscriber side to the device on the office side over a single line by switching between these data transmissions in time-division fashion, dividing data of one symbol, modulating carrier waves having different frequencies by each item of divided data and frequency-multiplexing the modulated signals, and transmitting the frequency-multiplexed signals in bursts a few symbols at a time, said apparatus comprising:

a timing-information insertion ~~means for inserting~~unit to insert timing information, which specifies an interval in which effects of crosstalk from a neighboring line are received, in a training symbol sequence at a time of training carried out prior to data communication; and

a transmitting unit ~~for transmitting~~to transmit the training symbol sequence in which the timing information is incorporated from the device on the office side to the device on the subscriber side,

wherein the timing-information insertion ~~means~~ unit inserts the timing information into the training symbol sequence to create a phase-change point by varying the phase of training symbols, and a time which is a set time before or a set time after the phase-change point is regarded as the start of said interval.

26. **(currently amended)** A digital subscriber line transmission system for transmitting downstream data from a device on an office side to a device on a subscriber side and upstream data from the device on the subscriber side to the device on the office side over a single line by switching between these data transmissions in time-division fashion, dividing data of one symbol, modulating carrier waves having different frequencies by each item of divided data and frequency-multiplexing the modulated signals, and transmitting the frequency-multiplexed signals in bursts a few symbols at a time, said system comprising:

a cable ~~for accommodating~~to accommodate said line as a first line and another line as a second line on which transmission of downstream data and transmission of upstream data are performed in time-division fashion;

a training-symbol transmitting unit ~~for transmitting~~to transmit a training symbol via said first line at a time of training carried out prior to data communication; and

a training-symbol receiving unit ~~for receiving~~to receive a training symbol via said first line;

said training-symbol transmitting unit including:

a timing-information insertion ~~means for inserting~~unit to insert timing information, which specifies an interval in which effects of crosstalk from said second line are received, into a training symbol sequence at a time of training carried out prior to data communication; and

~~means for transmitting~~a transmitting unit to transmit the training symbol sequence into which the timing information is inserted from the device on the office side to the device on the subscriber side; and

said training-symbol receiving unit including:

a timing-information extraction ~~means for extracting~~unit to extract the timing information from the training symbol sequence; and

a processor ~~for executing~~to execute training processing based upon the timing information,

wherein said timing-information insertion ~~means~~ unit inserts the timing information into the training symbol sequence to create a phase-change point by varying the phase between adjacent training symbols, and said timing-information extraction ~~means~~ unit detects said phase-

change point and adopts a time which is a set time before or a set time after the phase-change point as the start of said interval in which effects of crosstalk from the second line are received.

27. (previously presented) A method of digital subscriber line transmission which receives effects of crosstalk from an ISDN ping-pong transmission line, comprising the steps of:

varying a phase between adjacent symbols during a transmit interval of the ISDN ping-pong transmission as a FEXT interval; and

transmitting said symbols to a device on a subscriber side, thereby notifying the device on the subscriber side of the FEXT interval which receives effects of crosstalk from the ISDN ping-pong transmission line.

28. (previously presented) The method of digital subscriber line transmission according to claim 27, wherein the phase between adjacent symbols is varied at two positions within the FEXT interval.

29. (previously presented) The method of digital subscriber line transmission according to claim 27, wherein said steps of varying phase and of transmitting said symbols are executed at a time of training carried out prior to a data communication.

30. (previously presented) The method of digital subscriber line transmission according to claim 27, wherein said step of varying the phase includes the steps of:

quadrature-modulating a carrier wave of a predetermined frequency by said adjacent symbols; and

varying the phase between said adjacent symbols by 90° or 180° in a QAM constellation diagram.

31. **(currently amended)** A digital subscriber line transmission apparatus which receives effects of crosstalk from an ISDN ping-pong transmission line, comprising:

a phase varying unit ~~for varying~~to vary a phase between adjacent symbols during a transmit interval of the ISDN ping-pong transmission as a FEXT interval; and

a symbol transmitting unit ~~for transmitting~~to transmit said symbols and for notifying a device in a subscriber side of the FEXT interval which receives effects of crosstalk from the ISDN ping-pong transmission line.

32. (previously presented) The digital subscriber line transmission apparatus according to claim 31, wherein said phase varying unit varies the phase between adjacent symbols at two positions within the FEXT interval.

33. (previously presented) The digital subscriber line transmission apparatus according to claim 31, wherein said phase varying unit executes varying the phase between adjacent symbols, and said symbol transmitting unit transmits said symbols at a time of training carried out prior to data communications.

34. (previously presented) The digital subscriber line transmission apparatus according to claim 31, wherein said phase varying unit quadrature-modulates a carrier wave of a

predetermined frequency by said adjacent symbols, and varies the phase between said adjacent symbols by 90° or 180° in a QAM constellation diagram.

35. (new) A TDD-digital subscriber line transmission method for transmitting downstream data from a device on an office side to a device on a subscriber side and upstream data from the device on the subscriber side to the device on the office side over a single line by switching between these data transmissions in time-division fashion, dividing data of one symbol, modulating carrier waves having different frequencies by each item of divided data and frequency-multiplexing the modulated signals, and transmitting the frequency-multiplexed signals in bursts a few symbols at a time, said method comprising the steps of:

incorporating timing information, which specifies an interval in which effects of crosstalk from a neighboring ISDN ping-pong transmission line are received, in a training symbol sequence at time of training carried out prior to data communication; and

transmitting the training symbol sequence in which the timing information is incorporated from the device in the office side to the device on the subscriber side wherein the subscriber side determines a transmit interval for the upstream data and a receive interval for the downstream data based on the timing information,

wherein the timing information is incorporated in the training symbol sequence by changing the phase between adjacent training symbols during a transmit interval of the ISDN ping-pong transmission as a FEXT interval by the device on the office side and a phase-change point in the training symbol sequence is detected by the device on the subscriber side and a timing which is a set time before or a set time after the phase-change detection time is adopted as the start timing of said interval, and

wherein a carrier wave of a predetermined frequency is quadrature modulated and the phase between adjacent symbols obtained by quadrature modulation is varied by 90° or 180°.

36. (new) A TDD-digital subscriber line transmission apparatus for transmitting downstream data from a device on an office side to a device on a subscriber side and upstream data from the device on the subscriber side to the device on the office side over a single line by switching between these data transmissions in time-division fashion, dividing data of one symbol, modulating carrier waves having different frequencies by each item of divided data and frequency-multiplexing the modulated signals, and transmitting the frequency-multiplexed signals in bursts a few symbols at a time, said apparatus comprising:

timing-information insertion means for inserting timing information, which specifies an interval in which effects of crosstalk from a neighboring ISDN ping-pong transmission line are received, into a training symbol sequence at time of training carried out prior to data communication; and

transmitting means for transmitting the training symbol sequence, into which the timing information has been inserted, from the device on the office side to the device on the subscriber side wherein the subscriber side determines a transmit interval for the upstream data and a receive interval for the downstream data based on the timing information,

wherein said timing-information insertion means inserts the timing information into the training symbol sequence by changing the phase between adjacent training symbols during a transmit interval of the ISDN ping-pong transmission as a FEXT interval and the device on the subscriber side detects a phase-change point in the training symbol sequence and adopts a timing

which is a set time before or a set time after the phase-change detection time, as the start timing of said interval, and

wherein said timing-information insertion means quadrature-modulates a carrier wave of a predetermined frequency and varies by 90° or 180° the phase of adjacent symbols constructing a training symbol sequence.

37. **(new)** A TDD-digital subscriber line transmission system for transmitting downstream data from a device on an office side to a device on a subscriber side and upstream data from the device on the subscriber side to the device on the office side over a single line by switching between these data transmissions in time-division fashion, dividing data of one symbol, modulating carrier waves having different frequencies by each item of divided data and frequency-multiplexing the modulated signals, and transmitting the frequency-multiplexed signals in bursts a few symbols at a time, said system comprising:

a cable to accommodate said line as a first line and a second line as an ISDN ping-pong transmission line on which transmission of downstream data and transmission of upstream data are performed in time-division fashion;

a training-symbol transmitting unit to transmit a training symbol via said first line at time of training carried out prior to data communication; and

a training-symbol receiving unit to receive a training symbol via said first line;

said training-symbol transmitting unit including:

a timing-information insertion unit to insert timing information, which specifies an interval in which effects of crosstalk from said second line are received, into a training symbol sequence at time of training carried out prior to data communication; and

a transmitting unit to transmit the training symbol sequence into which the timing information is inserted from the device on the office side to the device on the subscriber side wherein the subscriber side determines a transmit interval for the upstream data and a receive interval for the downstream data based on the timing information; and

said training-symbol receiving unit includes:

a timing information extraction unit to extract the timing information from the training symbol sequence; and

a processor to execute training processing based upon this timing information,

wherein said timing-information insertion unit inserts the timing information into the training symbol sequence by changing the phase between adjacent training symbols during a transmit interval of the ISDN ping-pong transmission as a FEXT interval and said timing information extraction unit detects a phase-change point in the training symbol sequence and adopts a timing which is a set time before or a set time after the phase-change detection time, as the start timing of said interval in which effects of crosstalk from said second line are received, and

wherein said timing-information insertion unit quadrature-modulates a carrier wave of a predetermined frequency and varies by 90° or 180° the phase of adjacent symbols constructing a training symbol sequence..